PREDICTION OF CASSINI-HUYGENS GRAVITY MEASUREMENTS AS A FUNCTION OF TITAN'S RESPONSE TO SATURN'S ATTRACTION

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In an attempt to forecast which parameters of Titan's internal structure will be inferred from Cassini gravity observations (4 flybies dedicated so far to Radioscience measurements), Titan's tidal response to Saturn's gravitational field is computed for various models of the satellite interior. The models are constructed using constraints provided by numerical modelling of Titan's dynamics and thermal evolution. Some models can host an internal ocean, depending upon the content of ammonia mixed to the water. For the oceanless models, the decoupling effect of a low-viscosity high-pressure icy layer on Titan's gravitational response is discussed. This forward modelling takes into account tidal dissipation and the gravitational effect of the atmosphere. The computed parameters are the secular (ks) and dynamic (k2) Love numbers, which are directly linked to observable data J2 and J22, and which provide information on density and viscoelastic profiles, respectively. An accuracy up to 0.01 on k2 will highlight a deep ocean, and will provide rough information on the crustal thickness, with an uncertainty of the order of 100 km. A coupled analysis of ks and k2 will give strong constraints on the radius and nature of the core. Conclusions are drawn after reviewing all clues on Titan's internal structure, likely to be provided by the Cassini mission, such as magnetic and radar observations.